1967

REPORT TO THE CONGRESS

FROM THE PRESIDENT OF THE UNITED STATES

EXECUTIVE OFFICE OF THE PRESIDENT

NATIONAL AERONAUTICS AND SPACE COUNCIL

WASHINGTON, D. C. 20502

DEPARTMENT OF DEFENSE

CHAPTER IV

INTRODUCTION

In 1967 the Department of Defense space and aeronautical activity was highlighted by two actions: (1) Three TITAN IIIC boosters successfully placed 19 payloads into high orbits, some beyond synchronous. (2) The manufacture and assembly of the world's largest aircraft, the C5A, continued on schedule.

SPACE DEVELOPMENT ACTIVITIES

MANNED ORBITING LABORATORY

The MANNED ORBITING LABORATORY (MOL) progressed into the Engineering Development Phase early in 1967 and a program plan was developed to provide for the launch of a two-man crew aboard the spacecraft at the earliest possible date.

MOL crews will remain in orbit for 30 days conducting defense-oriented experiments involving very complex equipment. Manned space flight experience in the MERCURY and GEMINI programs indicates that both the development and usefulness of this equipment will be enhanced by putting a human operator/experimenter in space along with it. This approach will realize the program objectives of advancing both manned and unmanned space technology and ascertaining the full extent of man's utility in space.

The MOL crews will be launched into orbit inside a GEMINI B spacecraft by an uprated TITAN III booster, designated TITAN IIIM. In orbit the pilots will transfer into the laboratory, which is designed to allow them to work in a "shirt-sleeve" environment, unencumbered by space suits. For return to Earth, they will go back into the GEMINI B, detach it from the laboratory, and re-enter the atmosphere for an ocean landing and recovery.

Development of all of the major components of the MOL system was initiated and progressed on schedule during the past year. The first-stage engine of the TITAN IIIM, employing a new nozzle, was successfully static-tested. Mockup and structural test assemblies of the laboratory and experiment modules were completed and the procurement of system components was begun. Design of the launch complex at Vandenberg AFB, Calif., was completed and construction initiated.

Four more Aerospace Research Pilots were assigned to the MOL flight crew, increasing the total number in training to sixteen. In addition to their flight training and engineering and test operations duties, crew members completed courses in jungle and water survival.

Advance development and fabrication of space suits for the MOL flight crew began during this period. Special design features of the modified GEMINI-style pressure suits will include an extravehicular capability for emergencies, more mobile joints, a self-sealing zipper for unassisted donning and removal, and a bubble helmet for unrestricted visibility.

NASA and DOD continued close coordination and cooperation to insure the exchange of technology, hardware and experience throughout the life of both the APOLLO and MOL programs.

TITAN III Space Booster

The TITAN III Research and Development Program continued in the flight-test phase, with three launches carrying important military payloads into orbit throughout the year. The first of these occurred last January, when eight additional Initial Defense Communication Satellites were placed in a near-synchronous orbit of 18,200 nautical miles. This brought the total of communication satellites put into orbit by the TITAN IIIC to fifteen. In April, a pair of nuclear detection satellites were successfully boosted into an orbit of approximately 60,000 miles. The third flight of the TITAN IIIC took place in July and carried an assortment of six experimental payloads, including three additional Defense Communication Satellites.

Because of its demonstrated reliability and capability, the TITAN IIIC was ordered into production this summer to provide the space boosters for high-priority payloads over the next three years.

Development work continued on the TITAN IIIM, which will be used to launch the MANNED ORBITING LABORATORY (MOL). Launches of the TITAN IIIB also occurred during the year and development was initiated on a TITAN IIID configuration to provide a polar-orbit capability for heavier unmanned payloads.

DOD Communication Satellite Program

The DOD Satellite Communication Programs are divided into two broad categories (Long Distance Point-to-Point and Tactical Systems) supplemented by Supporting Research and Technology.

Long Distance Point-to-Point System

This system is to satisfy those unique and vital national security satellite communications needs which cannot be met by commercial means. Efforts to satisfy this mission can be classified into four areas: SYNCOM, Initial Defense Communications Satellite Project (IDCSP), Operational Defense Satellite Communications System (DSCS), and International Cooperative Efforts.

SYNCOM--The SYNCOM II and III satellites, developed and orbited by NASA, are used with DOD terminals in the Pacific area for passing operational traffic. The SYNCOM system was converted from R&D to an operational system in July, 1966, and is currently being employed in Southeast Asia to provide circuits between ground terminals there and in Hawaii and the Philippines. A shipboard terminal installed on the USS ANNAPOLIS is also being used in this system.

Initial Defense Communications Satellite Project (IDCSP)--The IDCSP provides the initial operational satellite communications capability to satisfy critical requirements of the DOD and other Government agencies. In 1967, the space subsystem was expanded to a total of 17 operational satellites with successful launches in January and July, utilizing TITAN IIIC R&D boosters.

The ground environment of the IDCSP has progressed with equal success. The former system of ground terminals on the east and west coasts of the United States and in Germany, Hawaii and the Philippines was expanded with additional terminals deployed to South Vietnam, Guam, Okinawa, Ethiopia and Hawaii. Recently developed air-transportable and highly mobile, lightweight terminals were deployed to Guam and Australia, and in Colorado and Alaska. Each of these terminals, which can be set up for operation with a six-man crew within an hour, provides a satellite communications facility making possible reliable and flexible communications for command and control for special military missions and for use in underdeveloped areas of the world. The Navy now has shipboard terminals installed in the USS PROVIDENCE, flagship of the Seventh Fleet; USS OKLAHOMA CITY, flagship of the First Fleet; USS WRIGHT; and USS ARLINGTON. In the near future, terminals will also be installed in attack aircraft carriers.

Defense Satellite Communications System (DSCS)--During 1967, the DOD continued planning and preparation for the development and acquisition of an advanced system which will take full advantage of our experience with the SYNCOM and IDSCP systems and current technology.

International Cooperative Efforts--A Memorandum of Understanding was concluded this year with the United Kingdom whereby the space segment of the IDCSP will be augmented with two synchronous satellites to provide operational defense communications. This program, which is entirely financed by the United Kingdom, will provide a first launch in 1968. To demonstrate the interoperability between British and U.S. satellite communications equipment, a Navy shipboard terminal in San Diego successfully communicated with a British shipboard terminal located in Portsdown, England. A similar program was proposed to NATO in September, 1966; in late August of this year, NATO indicated its desire to procure two UK-type satellites. These will be procured and launched in the U.S. by the Air Force.

Tactical Satellite Communications Program

The Tactical Satellite Communications Program made significant progress during 1967. The program consists of early experiments with two Massachusetts Institute of Technology Lincoln Laboratory satellites, followed by more extensive tests with a larger, more complicated satellite. These satellites will provide a means of exploring the technical, operational, and economic feasibility of using repeaters in space to satisfy certain critical tactical communication needs.

The first of the Lincoln Laboratory satellites was successfully orbited on July 1, 1967, and is providing valuable data. Experimental terminals installed in operational vehicles (airplanes, ships, and trucks) are communicating through the satellite and many new communication techniques are being tested. Army vehicular terminals established voice communication with various types of experimental terminals, some of which were at distances of over 4,000 nautical miles. The Navy has successfully communicated through the satellite with terminals installed in a

surface ship, submarine, and aircraft. In a related development, an Air Force helicopter in the USA successfully established two-way voice contact with a NASA station in Australia, utilizing NASA's ATS-1 VHF communications satellite repeater.

The U.S. and selected NATO countries are now conducting joint tests using the Lincoln satellite. A second Lincoln satellite for the TacSatCom program is under construction and will be launched in 1968.

Spaceborne Nuclear Detection (VELA)

The objective of the VELA Satellite Program is to develop a satellite capability to detect nuclear explosions which may occur from the Earth's surface to deep space. It is a joint research and development program of the DOD (USAF) and the Atomic Energy Commission.

Two new VELA satellites were successfully launched in April, 1967, by a research and development TITAN IIIC into 60,000-n.m. circular orbits. They joined six other VELA satellites launched in pairs in 1963, 1964 and 1965. The new satellites are stabilized with a gas-jet attitude-control system to keep their spin axes pointed at the center of the Earth. The most important new techniques being investigated are optical and electromagnetic pulse detectors for observing the fireball and radio pulses from nuclear weapons tested in the atmosphere.

All of the satellites are providing valuable information on the natural radiation background in space and the operation of nuclear radiation detectors in a space environment. The radiation background data are supplied to NASA, ESSA and DOD agencies for warnings during manned orbital flights and development of solar-storm forecasting techniques.

Space Object Identification

During 1967 the Air Force and the Advanced Research Projects Agency (ARPA) continued to cooperate in a research program to determine the most feasible methods of identifying the physical characteristics of non-cooperating objects in Earth orbit through observations by ground-based radar and photo-optical devices. Techniques developed will not only be used to obtain diagnostic information on our own satellites in orbit, but also will serve as a prime source of technology for improvement of the Space Surveillance and Detection Tracking System (SPADATS). Most ARPA research in this area has been transferred to Air Force management.

Geodetic Satellites

The DOD contined to participate in the geodetic satellite program during 1967. Satellites observed by DOD include: GEOS A, PAGEOS, NAVY NAVIGATION SATELLITES, SECOR and others. GEOS B (which carries an Army SECOR transponder, a NASA Range-Range Rate transponder, an Air Force Optical Beacon, and a Navy Doppler transponder in addition to laser reflectors and C-Band beacons) is to be launched shortly. The geodetic efforts will continue to provide more precise information about the Earth's size, shape, mass and variations in gravity and precise determinations of locations to support mapping, charting, and geodesy.

The Army Corps of Engineers began operations on a 30-station globe-circling network designed to provide a new determination of the Earth's equatorial radius, position critical range tracking stations, and provide scale to the PAGEOS network. The network advanced eastward from Hawaii traversing the U.S. and Canada to the continent of Africa. One SECOR satellite, EGRS IX, was successfully orbited in 1967 into a 2,000-nautical mile polar orbit.

Doppler information using primarily the NAVY NAVIGATION SATELLITES, GEOS-A and France's ALOUETTE was collected by the 13 permanent stations and four mobile vans. In addition, the tracking station at McMurdo Sound, Antarctica, was reactivated by the National Science Foundation. During 1967 the Navy determined from Doppler observations the positions of 18 stations to an accuracy of $\pm$ 25 meters with respect to the Earth's center-of-mass from Doppler observations. Additionally, the Doppler data was used to better define the model of the Earth's gravity field. Harmonic coefficients of the gravity potential have been extended to the twelfth order and degree. A lightweight, portable tracking station, called the GEOCEIVER, will be delivered shortly to replace the breadboard model which became operational during 1967. The GEOCEIVER will consist of a new receiver, antenna, and data package. It weighs approximately 80 lbs. and is designed to be transported by one man.

The PAGEOS satellite launched in June, 1966, is being observed by DOD and the Coast and Geodetic Survey for establishing a worldwide Geometric net of 43 stations. PAGEOS is a reflective 100-ft. inflatable sphere which is observed in relation to the star background. Observations have been accomplished from a total of 24 of the 43 stations.

With the development of a chopping shutter, Air Force PC-1000 cameras are able to observe passive satellites. The objectives now are to provide densification to support mapping and charting efforts, to supply data for radar calibration, and to position strategic locations such as Air Defense Tracking stations. The PC-1000 teams have completed radar calibration and ADT site positioning efforts and are now deployed for densification.

NAVY NAVIGATION SATELLITE System

A constellation composed of three NAVY NAVIGATION SATELLITES was maintained in operation during most of 1967. Three replacement satellites, with improved electronic components and power systems and an expected longer lifetime, were interjected into the constellation in the course of the year.

NAVIGATION SATELLITE System receivers are installed in all Fleet Ballistic Missile submarines and all attack carriers deployed to Southeast Asia, both to update the ship's interial navigation system and to provide data for the aircraft navigation systems prior to launch from the carriers.

On July 29, 1967, the Vice President of the United States announced that the NAVY NAVIGATION SATELLITE System had been released for use by civilian ships and that the shipboard receivers could be manufactured commercially on an unclassified basis.

Also during 1967, four small navigation satellite receivers, suitable for a man-to-back pack, were delivered to the Navy. These, along with the two sets delivered in 1966, were tested under simulated field conditions to determine how accurately they could locate themselves in relation to one another. They have now demonstrated accuracies equivalent to those achieved by surveying.

A satellite navigation receiver designed and manufactured for aircraft employment was delivered to the Navy in October and will be extensively tested in flight in cooperation with the Air Force during 1968.

SPACE GROUND SUPPORT

DOD National Ranges

The Air Force is realigning the management structure for its operation of the DOD ranges. This action will streamline and simplify the management chain, provide a more responsive, faster-reacting system, and save manpower. The realignment in the Air Force Systems Command (AFSC) replaces the National Range Division (NRD) by establishing as the range focal point the AFSC Deputy Chief of Staff for Operations. Within Headquarters USAF, the range monitoring functions have been placed under the Director of Space.

Range instrumentation continues to be improved through modernization of existing trajectory measuring systems and conversion of telemetry systems to operation in the Ultra High-Frequency (UHF) band.

Eastern Test Range--During much of this year, acceptance testing continued on the eight C-135 APOLLO/Range Instrumented Aircraft. These aircraft will provide support to DOD missile programs as well as the APOLLO program in areas not covered by land and ship stations. All eight aircraft will be operational by January, 1968. Data-acquisition capability of Advanced Range Instrumentation Ships is being improved to provide increased support to re-entry systems development and evaluation and space missions.

Western Test Range--The five APOLLO ships are undergoing operational testing and the entire fleet will be operational by March, 1968. Terminal-area scoring and recovery capabilities have been improved by the addition of a new bottom-mounted acoustical hydrophone and the acceptance of a new two-man submarine. Work continued on the TITAN IIIM launch complex in the Sudden Ranch area.

Satellite Control Facility--A substantial effort has been made to upgrade the overall capabilities of the Satellite Control Facility to support more numerous and complex satellite programs in the FY 1970-1975 era. Contracts have been negotiated to provide all tracking stations in the network with the Space Ground Link Subsystem (SGLS). This equipment will accomplish the conversion of all telemetry to the S-band and significantly improve tracking and command capabilities. A large addition has been approved for the Satellite Test Center to provide modern Mission Control Complexes, from which the on-orbit satellites are controlled on a round-the-clock basis. The new building will house an Advanced Data System (ADS) and the Expanded Communications Electronics System (EXCELS).

DEPARTMENT OF STATE

CHAPTER VI

INTRODUCTION

On January 27, in a ceremony presided over by the President, the Secretary of State and the Ambassador to the United Nations signed the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies."

On October 10, the President presided over a further ceremony marking the entry into force of this Treaty. On this occasion the President noted that: "The spirit of international cooperation that has achieved this agreement is a beacon of hope for the future. It is a credit to all peoples." In the course of his remarks, the President said: "I want to renew, today, America's offer to cooperate fully with any nation that may wish to join forces in this last -- and greatest -- journey of human exploration. Space is a frontier common to all mankind and it should be explored and conquered by humanity acting in concert." The President also said: "The next decade should increasingly become a partnership -- not only between the Soviet Union and America, but among all nations under the sun and stars."

The General Assembly on December 19 unanimously adopted a resolution approving an Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space. The Agreement elaborates rights and obligations of the Outer Space Treaty, among them the duty of signatories to take all possible steps immediately to rescue astronauts in distress and to render them all necessary assistance. Negotiations on this agreement were conducted between the United States and the Soviet Union in close consultation with other members of the UN Outer Space Committee.

Eighty-four countries had signed the Outer Space Treaty and 13 had ratified it as of October 10.

On February 6, at the request of the Soviet Union, the United Nations Conference on Outer Space, which had previously been scheduled for September, 1967, was postponed until August 14-27, 1968. The conference, to be held in Vienna, will emphasize the practical applications and benefits of space programs, with special reference to the needs of developing countries, and opportunities for international cooperation in space activities.

As part of its contribution to the national space program, the State Department continued its efforts to foster international cooperation in the peaceful uses of outer space and foreign support for various aspects of the program, including negotiation

of station agreements. It assisted in plans for contingency arrangements for astronaut recovery and continued to take an active part in encouraging broad participation in the development of a commercial global satellite communications system. It also maintained close consultation with other appropriate U. S. agencies regarding possibilities for developing future international cooperative efforts in space science and applications, such as the surveying of Earth resources from satellites.

ACTIVITIES WITHIN THE UNITED NATIONS

As indicated, the Outer Space Treaty has entered into force and the plans for the conference in Vienna in 1968 are under development.

The United Nations Outer Space Committee's Legal Subcommittee laid the groundwork for the agreement on assistance to and return of astronauts and space objects and continues its work on a convention on damages caused by the launching of objects into outer space. The Subcommittee also began a study of problems relating to a possible definition of outer space, and discussed questions relating to various uses of space.

The Technical Subcommittee of the U. N. Outer Space Committee considered matters relating to exchange of information, encouragement of international programs, international sounding rocket facilities, education and training, and definition of outer space. On the question of definition (which had been referred to it by the Legal Subcommittee), it concluded that it was impossible at present to formulate a useful definition of outer space on the basis of scientific or technical criteria.

Outer space was again discussed by the First Committee of the General Assembly between October 17 and October 20. The Committee adopted by acclamation two resolutions, the first requesting the Outer Space Committee to continue its present activities and the second urging the widest possible participation in the U. N. Space Conference. One new activity which the first resolution requested the Outer Space Committee to undertake was a study of the technical feasibility of direct broadcast communications from satellites, as well as the current and foreseeable developments in the field. On November 3 the two First Committee resolutions were adopted without dissent by the General Assembly meeting in plenary session.

TRACKING NETWORKS

Agreements are in existence with the following countries covering the foreign portion of NASA's global tracking network: Australia, Canada, Chile, Ecuador, Malagasy Republic, Mexico, Peru, South Africa, Spain and the United Kingdom. These facilities consist of stations supporting the manned space flight program, a tracking and telemetry network for scientific satellites, and deep-space antennae at four locations around the world. An agreement for a tracking station on Antigua in connection with Project APOLLO was concluded in January, 1967. After a NASA review of its tracking requirements determined that the facilities at Canton Island would no longer be required, the United Kingdom was notified of the intention to terminate use of that station at the end of 1967.

The ESRO (European Space Research Organization) satellite telemetry and command station near Fairbanks, Alaska, was undergoing testing in late 1967 and will be available when ESRO satellites are launched under the terms of a cooperative agreement between ESRO and NASA. This station, manned largely by U. S. contractor